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USE OF DOPPLER POSITIONING METHOD IN CADASTRAL SURVEYS AND BOUNDARY DEMARCATIONS

By

S.N. Mattey and B.W.L Chodota
RCSSMRS

I. INTRODUCTION

1. All over Africa there is a feeling of urgency in coping with the tempo of development taking place. There is the urgency to increase food production to cope with increase in population. There is the urgency to increase industrial production to cope with the demand of consumer industrial products.

2. In the heat of this kind of urgency many investors are acquiring parcels of land either as agricultural and/or industrial plots.

3. These many parcels of land need to be surveyed before legalization of acquisition can be effected.

4. New settlements are being set up in Africa and these settlements need to be surveyed so that title deeds can be obtained. These title deeds may serve as security for financiers or the survey plans can be used for planning purposes.

II. THE PROBLEM OF POOR SURVEY CONTROL COVERAGE

5. In general, Africa is very poorly covered by survey control. This shortage has created a chain of other related problems such as delays in survey work, delays in production of maps and delays in implementing other development projects such as agricultural projects and establishment of road networks.

6. In case of agricultural projects the survey work may be useful when finances are to be borrowed from financial institutions which require a title certificate (deed) as security before granting loans. In a poorly controlled area it may take a long time before the survey party can connect the survey work of the area to the national grid, a requirement which must often be met before the cadastral work is approved.

III. THE PROBLEMS OF SURVEY EQUIPMENT AND SURVEY METHODS

7. Due to high prices of modern survey equipment, most survey departments are still equipped with the old conventional survey equipment. In most cases the main field equipment would comprise the theodolite, an EDM equipment and the level. This equipment is ideal for small-scale surveys where using more expensive equipment would not be recommended.

8. However, for large-scale surveys, such as those of ranches and big farms, the use of the conventional survey equipment is time-consuming and very labour-intensive.

IV. THE USE OF DOPPLER RECEIVERS AND OTHER MODERN SURVEY EQUIPMENT

9. The introduction of the Doppler and the Global Satellite System (GPS) receivers in the survey field was a big relief to those involved in the profession.

10. The equipment is not weather dependent (in most cases), intervisibility between sets in not necessary and the operation is simple. So there is a great cut down in field expenses, manpower and time. It can be shown (Hoar, G.J.) that using the Doppler receiver instead of the conventional equipment in fixing control points there is a gain in time of about 70 per cent and a financial saving of up to 50 per cent. With the GPS sets there should be even a bigger gain.

11. In terms of accuracy, with the Doppler sets being operated in the translocation mode, the horizontal position accuracy achievable can be as good as 10.5 metres (1 sigma) for 17 acceptable passes common at each station (Hoar, G.J.). With baselines of 10-15 km, relative accuracy better than 1/10,000 can easily be achieved. The GPS sets can provide proportional 3-D positional accuracies of from 10 ppm to 1 ppm (Cain, J.D.).

V. EXPERIENCES AT RCSSMRS IN USING DOPPLER POSITIONING TECHNIQUE IN CADASTRAL SURVEYS

12. The Regional Centre for Services in Surveying, Mapping and Remote Sensing, Nairobi, Kenya, has conducted Doppler surveys in Mtwara and Arusha in the United Republic of Tanzania. The established control was intended to assist in the demarcation of village boundaries so that the villages could obtain titles (certificates of occupancy) to enable them to obtain loans from financial institutions. The control points could also be used for other surveys required for other surveys required for other development projects.

13. The projects have all been a success since about 100 points were fixed in Mtwara in a field-period of nine months and about 30 points in Arusha within a field period of three months. If conventional methods were used, each of the projects should have taken a number of years to complete.

VI. THE PROBLEM AND SOLUTION OF THE HIGH COST OF MODERN EQUIPMENT

14. The high cost of the Doppler and GPS receivers has been the main hindrance to most survey departments in acquiring the equipment.

15. Furthermore, most departments argue that the use of the equipment is quite limited after the densification exercise. However, this argument is now losing ground as these departments start establishing their Geographical Information Systems (GIS) where GPS receivers are very handy in acquiring the required field data.

16. One solution to the problem of high cost of the equipment can be reached through regional co-operation. Simply put, this means that such equipment can be purchased by contributions from a number of countries or institutions and a programme worked out so that the equipment can be rotated among the member countries when needed. This has been achieved in the case of the contributing member countries at RCSSMRS where the Doppler receivers can be used in about 22 countries. Other regions in Africa could establish such regional co-operation agreements or use the existing regional scientific centres as co-ordinating centres.

17. This is not a new concept as this mode of co-operation is clearly spelt out and emphasized in the Lagos Plan of Action for the Economic Development of Africa.

VII. SUMMARY

18. There is a very high demand of cadastral surveys in Africa due to the high rate of development all over the continent.

19. To cope with this high demand of cadastral surveys, survey departments are encouraged to adopt modern methods and equipment to supplement the conventional ones. The use of Doppler (or GPS) receivers in establishing control for the demarcation of cadastral boundaries has proved very cost-effective and time saving.

20. The problem of high cost of modern equipment can be solved through the establishment of regional co-operation agreements where resources can be pooled together to acquire such equipment.

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